SHORT REPORT

Traumatic homonymous hemianopia

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Objective: To describe the characteristics of patients with homonymous hemianopia from traumatic brain injury (TBI) seen in our unit between 1989 and 2004.

Methods: Only patients with a history of TBI, who had detailed clinical information and results of neuroimaging, were included in our study. Demographic characteristics, clinical features, types of visual field defects, location of lesion and evolution of visual field defects were recorded.

Results: Of the 880 patients with homonymous hemianopia seen in our unit, 103 patients (112 with homonymous hemianopia) had TBI (74 men and 29 women, mean age 30.7 (SD 15.3) years). Median time from injury to initial visual field testing was 5 (range 0.5–360) months. In all, 64 (57.1%) patients sustained injuries that were motor vehicle-related; 19 (17%) violence-related; 17 (15.2%) due to falls; and 12 (10.7%) because of other blunt head trauma. Visual field defects included complete homonymous hemianopia in 44 (39.3%) patients and incomplete homonymous hemianopia in 68 (60.7%) patients. The lesion was occipital in 14 (12.5%) patients, associated with optic radiation in 26 (23.2%) and the optic tract in 12 (10.7%), and multiple in 60 (53.6%).

Conclusion: Most cases of homonymous hemianopia from TBI were motor vehicle-related. Patients were younger, more often male, and had multiple brain lesions more often than patients with homonymous hemianopia from causes other than TBI. A median delay of 5 months was observed before the documentation of the homonymous hemianopia, which may have a major effect on the success of rehabilitation and driving training in these young patients.

Retrochiasmal visual field deficits account for a quarter of the visual sequelae caused by traumatic brain injuries (TBI) and constitute one of the most common neuro-ophthalmological consequences of head trauma.[1] Homonymous visual field deficits may affect patients' ability to drive, to read and to continue in their current employment.[2–5] Despite the disabling nature of these visual field deficits, there is little known about the nature and course of these injuries, and this lack of knowledge has hampered the development of rehabilitative treatments aimed at reducing their effect. Our study describes the characteristics of homonymous hemianopia secondary to TBI in a large series.

METHODS

We retrospectively reviewed the medical records of all patients with homonymous hemianopia evaluated in the Neuro-Ophthalmology Unit, Emory University, Atlanta, Georgia, between August 1989 and June 2004. Only those cases with detailed clinical information, a history of TBI and results of head CT or brain MRI were included. All patients had homonymous hemianopia confirmed by Goldmann visual field testing (GVF), Humphrey visual field testing or confrontation visual field examination. All GVF tests were carried out by the same technician and all confrontation visual field examinations were carried out by an experienced neuro-ophthalmologist (NJN and VB, respectively). Patients with bilateral homonymous hemianopia were recorded twice so that each homonymous hemianopia (right and left) could be analysed separately. The study was approved by the Emory Institutional Review Board.

Demographics of patients, type of visual field defects, time between injury and first neuro-ophthalmic evaluation, type of injury, causative brain lesion, neuro-radiological determination of lesion location, visual field outcome and neurological outcome were analysed. The time since injury was defined as the time from the TBI to the first visual field examination. The location of the brain lesion was classified as described in another report.[6]

Visual field defects were defined as complete homonymous hemianopia and incomplete homonymous hemianopia. Incomplete homonymous hemianopia included homonymous quadrantanopia, homonymous hemianopia with macular sparing, homonymous scotomatous defects, homonymous sectoranopia and unilateral loss of temporal crescent as detailed in a previous report.[6] Congruency was defined as identical homonymous hemianopia in the fields of the two eyes in shape, depth and size.[7]

RESULTS

Of the 880 patients with homonymous hemianopia seen in our unit, 103 patients (including nine with bilateral homonymous hemianopia) had a TBI. Formal visual field testing was obtained in 95 (92.2%) of these patients, of whom 93 were evaluated by GVF testing. Analysis was carried out on 112 patients with homonymous hemianopia.

In all, there were 74 (71.8%) men and 29 (28.2%) women, with a mean age of 30.7 (SD 15.3, median 29, range 4–73) years. Of them, 69 (61.6%) patients were Caucasians and 28 (25.0%) African-American.

Causative injuries in patients were motor vehicle-related in 64 (57.1%), violence-related in 19 (17%), due to falls in 17 (15.2%) and due to other blunt head trauma in 12 (10.7%). Of the motor vehicle-related cases, 54 (84.4%) were caused by motor vehicle collisions, 6 (9.4%) due to the patient being struck by a vehicle and 4 (6.2%) by motorcycle accidents. Of the violence-related injuries, 11 (57.9%) were firearm-related whereas 8 (42.1%) were not. Fall distances ranged from ground level to a skydiving accident. Almost all the cases of other blunt head trauma included patients being struck by falling or flying objects (eg, during baseball or on industrial sites). The remaining cases included a boat accident and a case of blunt trauma of unknown cause.

Table 1 summarises the visual field characteristics, location of lesion, time from injury to the first visual field test and associated neurological deficits. All types of visual field defects and locations of lesion were observed. More than 50%

Abbreviations: GVF, Goldman visual field testing; TBI, traumatic brain injury of cases, however, had multiple cerebral lesions. Most patients (79.8%) had additional neurological deficits. Median time from injury to the initial visual field testing was 5 (range 0.5–360) months. Follow-up visual fields were available in the case of 21 traumatic hemianopias, and improvement was observed in 8 (38.1%) of these patients with homonymous hemianopia. All patients showing improvement were evaluated within 3 months of their initial injury (average 1.9 months).

DISCUSSION

This study presents homonymous hemianopia secondary to TBI in a large series. Homonymous hemianopias have a major legal and financial impact because of their effects on driving and vocational rehabilitation.[2–4] Additionally, these deficits affect patients' quality of life by affecting reading and other tasks.[5] Despite the consequences of these deficits on patients' quality of life and on society, there is no standard of rehabilitation for these lesions.[8] Although homonymous hemianopia is a common sequela of TBI, little is known about these lesions.[1] In the three largest case series of homonymous hemianopia in the English literature, trauma was not evaluated separately or constituted <5% of the cases.[9–11]

Notably, traumatic causes accounted for more than 10% of our cases. This is explained by the high level of awareness on visual dysfunction in patients with head trauma among the rehabilitation services referring patients to our unit. It also suggests that visual field defects are often overlooked in patients with head trauma.

Several key characteristics differentiated our traumatic homonymous hemianopia cases from our larger population with homonymous hemianopia and from other series.[6 9–11] The patients' characteristics mirrored the traditional demographics of patients with trauma, as they were more likely to be men and younger. During the period of this study, however, the difference in injury rate between men and women became non-significant.[12] The large proportion of male patients with injuries may either represent a true difference in the type of traumatic injuries that men suffer compared with those suffered by women or be a consequence of the higher frequency of patients who were African-Americans in our population. Our population had twice the number of African-Americans as the general population (26% *v* 12.9%), and African-American men have nearly twice the rate of traumatic injury as women of either race and also have a noticeably higher rate of injury than white men.[12 13]

Another characteristic that differentiated patients with traumatic homonymous hemianopia cases from our larger population of patients with homonymous hemianopia was the higher frequency of multiple brain lesions that could account for their visual field defects. Therefore, it is difficult to determine whether a single lesion or more than one lesion accounts for the visual field defects observed. The higher frequency of multiple lesions and the observed 80% frequency of other neurological deficits suggest that this is most likely a consequence of the diffuse cerebral pathology often caused by severe head injuries. Indeed, the high proportion of patients with associated neurological deficits in this study suggests diffuse brain injuries. In addition, Uzzell *et al*[14] found that the presence of visual field deficits portended more severe neuropsychological impairment within severity groups on the basis of the Glasgow Coma Scale score.

Because almost all our patients with trauma were referred to our neuro-ophthalmology unit by rehabilitation services, probably this group has a selection bias towards more severe or injurious lesions. If this is the case, however, it is particularly unsettling that there was such a long period of latency before these more debilitating lesions came to our attention. Despite patients not complaining of their defects and accurate testing not being possible in the immediate post-injury period, this information can probably be attained earlier by using a systematic approach.[15 16] Furthermore, several studies show that even automated perimetry can be obtained in patients with severe neurological comorbitities.[17–19] Given the brief natural history of visual field recovery seen after stroke and in homonymous hemianopia in general,[20 21] rehabilitation targeted at facilitating and improving this natural recovery period will need to be initiated soon after the injury occurs. Therefore, ascertaining the nature and extent of these injuries as soon as possible may be of paramount importance. In this study, all patients with spontaneous improvement were first evaluated within 3 months of their initial injury, suggesting that a narrow window may also exist for maximal recovery after trauma. This is emphasised by the finding that spontaneous improvement of homonymous hemianopia decreases with the time to the patient's first evaluation, suggesting that the sooner the rehabilitation begins, the more likely it is that recovery may be facilitated.[21]

In summary, traumatic homonymous hemianopia occurs more commonly in young men, and as a consequence of a wide variety of head injuries. They often occur in the setting of multiple brain lesions and are associated with other neurological deficits. This study emphasises the importance of early, systematic evaluation of all patients with traumatic head injury for homonymous hemianopia, as it is important for the functioning and rehabilitation of the patient.

Table 1 Characteristics of 112 patients with homonymous hemianopia related to traumatic brain injuries

Types of visual field defects at baseline	
Complete HH	44 (39.3%)
Incomplete HH	68 (60.7%)
Homonymous quadrantanopia	36 (32.1%)
Partial HH	16 (14.3%)
HH with macular sparing	3 (2.7%)
Homonymous scotomatous defects	11 (9.8%)
Homonymous sectoranopia	1 (0.9%)
Unilateral temporal crescent	1 (0.9%)
Congruity of visual field defects	
Congruous	35 (31.2%)
Incongruous	29 (25.9%)
Not available (including two one-eyed cases and one ULTC case)	47 (42.9%)
Location of lesion	
Occipital	14 (12.5%)
Optic radiation	26 (23.2%)
Optic tract	12 (10.7%)
Multiple	60 (53.6%)
Time from injury to initial visual field test (median (SD))	5 (60.1) (range 0.5–360) months
Associated neurological deficits	
Isolated HH	22 (20.2%)
Non-isolated HH	87 (79.8%)
Not available	5
Follow-up	
Improved	8 (38.1%)
Not improved	13 (61.9%)
Not available	91

HH, homonymous hemianopia; ULTC, unilateral temporal crescent.

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